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Request for grant of a patent

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The Patent Office

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1. Your reference

2. Patent application number
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9919741.0

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

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Patents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention

AN IMPROVED OIL/WATER SEPARATING DEVICE.

5. Name of your agent *(if you have one)*

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

F51/77
22-6-2000
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6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
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Continuation sheets of this form	0
Description	3
Claim(s)	2
Abstract	1
Drawing(s)	2 - 2

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	
Request for substantive examination *(Patents Form 10/77)*	
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11. I/We request the grant of a patent on the basis of this application.

Signature [signature] Date 20-3-99

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JOHN TIMMINS
01922 402601

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Sheet 1

AN IMPROVED OIL/WATER SEPARATING DEVICE

This invention relates to an improved oil/water separating device.

Please note that in this document:
Solution means any mixture or emulsion or solution formed by oil and water in any proportions, whether containing other ingredients or not.
Vessel means any container of whatever shape or size or number, holding a quantity of solution.
Oleophilic bag means any bag or net or porous or perforated container of any description made of or from or holding a quantity of oleophilic and hydrophobic material or similar substance of any kind. This material is commercially available in various forms including a melt blown polymer and when clean and uncontaminated is very light in weight, enabling it to be easily supported by, for example, a water based solution.
Carbon bag means any bag or net or porous or perforated container of any description made of or from or holding a quantity of activated carbon or similar or substance of any description used or suitable for the purpose of removing contaminants from water.
Adsorbed means adsorbed or absorbed or soaked up or into in any way.

Solutions are common in industry, for example, condensate from many compressed air systems consists mainly of a mixture of water from the air and oil from the compressing process, with some of the oil emulsifying with the water.
To comply with legislation, some of the oil must be removed before the remaining water with, typically, a maximum oil content of 20ppm., can be legally disposed of into drains or even onto the ground.
Most existing oil/water separators (see Drawing A) collect the solution to be cleaned by means of an inlet system 1 into a settling tank 2 with a weir device 3 arranged to 'float off' any oil which settles on the surface of the solution 4, with the more clean solution from towards the bottom of the settling tank 2 subsequently being passed through a transfer pipe 5 into a vessel containing activated carbon 6 for final cleaning, but some oils in some circumstances form a thick solution known as 'mayonnaise' which will not pass over the weir system but continues to accumulate until it reaches the bottom of transfer pipe 5 and passes into the carbon bag section of the machine where it will block the activated carbon 6 which, as more solution is passed into the settling tank 2, causes untreated solution to overflow the weir 3. In an attempt to overcome this problem, all manufacturers of this type of machine now supply an oleophilic bag 7 which sits on top of the carbon bag 6 to remove any 'mayonnaise' before it can block the carbon bag 6. This system is not satisfactory, however, as the amount of oleophilic material supplied is small and is quickly overloaded by the 'mayonnaise'. This type of machine, therefore, is very susceptible to blocking.

According to the present invention, referring to Drawing B, a primary vessel 1 containing an oleophilic bag 2 is constructed with an inlet or inlets 3 at or towards the top end of the primary vessel 1 to allow solution to be treated to enter the

primary vessel 1, and a transfer pipe 4 at or towards the bottom of the primary vessel 1 to allow solution to flow from the lower part of the primary vessel 1 into a secondary vessel 5 containing a carbon bag 6, the level of solution 8 contained in both primary and secondary vessels being controlled by means of an exit pipe 7 from the secondary vessel 5 at the required height 10. Alternatively, both the oleophilic bag and the carbon bag may both be contained in a single vessel, one above the other. The oleophilic bag 2 being a loose fit in the primary vessel 1 will float on or towards the surface of the solution 8 and be supported by solution 8 and any solution added to the primary vessel 1 through inlet 3 must fall onto or make contact with the oleophilic bag 2. The oleophilic bag 2 will be caused to move up or down inside the primary vessel 1 by either the level of solution 8 rising or the weight of oleophilic bag 2 increasing.

After initial priming with clean water until the water overflows from the exit pipe 7, the very lightweight oleophilic bag 2 will float on the surface of the water in the primary vessel 1. Any oil, either emulsified or un-emulsified, entering the primary vessel 1 above the surface of the solution 8 will make contact with and will tend to be adsorbed into the oleophilic bag 2 whilst any emulsified or un-emulsified oil not initially removed by contact with oleophilic bag 2 will fall into the solution 8 contained by primary vessel 1 in which the oleophilic bag 2 is floating. The lower density of any oil in any form will tend to cause the oil to float at or near to the surface 10 of the solution 8 where it can again make contact with and be adsorbed into the oleophilic bag 2. As further quantities of solution 8 are admitted to the primary vessel 1, similar quantities of solution 8, now containing much less oil, will pass into the secondary vessel 5 through the transfer pipe 4 and through the carbon bag 6 for final cleaning before leaving the machine through exit pipe 7.

As more solution 8 is fed into the primary vessel 1 and more oil is adsorbed by the oleophilic bag 2, causing the oleophilic bag 2 to increase in weight and to sink further into the solution 8 contained by primary vessel 1. Any oil adsorbed by the upper part of the oleophilic bag 2 will tend to flow downwards under its own weight and, as a result, oil will tend to collect in the lower portions of oleophilic bag 2, the extra weight of the adsorbed oil causing the lowest portions of the oleophilic bag 2 to sink further beneath the surface 10 of the solution 8 causing a fresh part of the oleophilic bag 2 to make contact with any floating oil. This process will continue until all or most of the oleophilic bag 2 is saturated or nearly saturated with oil, at which stage the oleophilic bag 2 will be floating low in the solution 8 and will require to be replaced.

Should the oleophilic bag 2 not be totally hydrophobic and should the initial weight of the oleophilic bag 2 cause the lower portion of the oleophilic bag 2 to sink below the surface 10 of the solution 8, the lower portion of the oleophilic bag 2 may then adsorb water from the solution 8, causing the oleophilic bag 2 to increase in weight causing more of the oleophilic bag 2 to sink, the process continuing and preventing the proper operation of the oleophilic bag 2. This problem is worse when the primary vessel is tall and narrow so that the oleophilic bag 2 has its weight concentrated onto a small cross sectional area. This premature sinking means that the portion of the oleophilic bag 2 sunk beneath the surface 10 of the solution 8 is unable to adsorb more oil as, because oil is less dense than the solution 8, any oil will tend to float on or to the surface of the solution 8 and hence oil will tend not to make contact with the part of the oleophilic bag 2 which is beneath the surface 10 of

the solution 8 and also any part of the oleophilic bag 2 which is beneath the surface 10 of the solution 8 will adsorb water from the solution 8 which will reduce the buoyancy of the oleophilic bag 2. As a reduction of buoyancy is effectively the same as an increase in weight, the effect of this loss of buoyancy will be to cause more of the oleophilic bag 2 to sink beneath the surface of the solution 8 to adsorb more water and the process will continue until most of the oleophilic bag 2 is prematurely sunken and needs to be replaced. To overcome this problem, a further feature of the present invention is to provide a support which will cancel out the initial weight of the oleophilic bag 2 so that the oleophilic bag 2 will initially be prevented from sinking into the solution 8 under its own weight. This support could be a float 11 made from some lightweight and water resistant material or the oleophilic bag 2 could be suspended by means of a spring or some sort of elastic or rubber device or it could be counterbalanced in some way. In any case, the weight of the oleophilic bag 2 is initially fully supported so that the oleophilic material part of oleophilic bag 2 is held at or on or just above the surface 10 of the solution 8, the support being so devised that, as the oleophilic bag 2 gains weight due to adsorbing more oil, the oleophilic bag 2 will begin to sink into the solution 8 as described previously but at all times the oleophilic bag 2 will remain fully supported in equilibirum. until additional oil is adsorbed to cause the oleophilic bag 2 to sink a little further into the solution 8. The adsorbtion of any water from the solution 8 by the oleophilic bag 2 is therefore totally or nearly totally prevented and any water which may subsequently be adsorbed by the sunken part of the oleophilic bag 2 will be beneath the surface of the solution 8 and will have little or no effect as the portion of the oleophilic bag 2 beneath the surface of solution 8 will already be mostly or totally loaded with oil.

CLAIMS.

Please refer to drawing B for all Claims references.

Claim 1) An oil/water separating device consisting of a vessel or vessels holding some quantity of an oil/water solution to be separated such that an oleophilic bag is able to fully or partially float or to fully or partially sink on and/or into the solution according to its weight, the very lightweight oleophilic bag will initially float on the top of or nearly on the top of the solution where the oleophilic bag will tend to adsorb any available oil which makes contact with it. As more oil is adsorbed by the oleophilic bag, the oleophilic bag will become heavier and will sink further into the solution, causing fresh, unused parts of the oleophilic bag to reach the surface of the solution, whilst the used and partially or fully saturated parts of the oleophilic bag which were at the surface of the solution sink progressively further beneath the surface of the solution. The oleophilic bag will therefore be progressively sunken and this process will continue until the oleophilic bag is partially or fully loaded with oil or until all or most of the available oil is adsorbed, whichever is first.

Claim 2) An oil/water separating device using a floating oleophilic bag as claimed in previously, the part or parts of the oleophilic bag beneath the surface of the solution will contain and retain more oil than a similar part of a similar oleophilic bag surrounded by air as the oil contained by the sunken part of the oleophilic bag, being fully supported by the solution, will effectively not have weight and will therefore not be drawn out of the oleophilic bag by gravity.

Claim 3) An oil/water separating device using a floating oleophilic bag as claimed previously enables a simple estimation of the amount of oil adsorbed by the oleophilic bag to be judged, according to the amount of oleophilic bag remaining above or below the surface of the solution compared to its initial or starting position.

Claim 4) An oil/water separating device using a floating oleophilic bag as claimed previously enables a direct judgement of the amount of oil adsorbed by the oleophilic bag to be made by means of a rod or similar indicator with its bottom end resting on or connected to the oleophilic bag in some way with its top or other end visible from outside the vessel such that a movement of the bag downwards will cause the rod to move downwards and hence to indicate the position of the oleophilic bag in the vessel and hence the amount of extra weight due to the increased oil content of the oleophilic bag.

Claim 5) An oil/water separating device using a floating oleophilic bag as claimed previously enables a direct judgement of the amount of oil adsorbed by the oleophilic bag to be made by means of a string or other such device with one end fastened in some way to the oleophilic bag with the other end outside the machine

such that a movement downwards of the bag filled with oleophilic and hydrophobic material will cause the string or other such device to move an indicator or similar visible sign of the position of the oleophilic bag in the container and hence the amount of extra weight and hence oil content of the oleophilic bag.

Claim 6) An oil/water separating device using a floating oleophilic bag as claimed previously will indicate, should the carbon bag become blocked, causing the solution level in vessel 1) and hence the oleophilic bag and hence the indicating device as described in claim 3), claim 4) and claim 5) or other such or similar devices, to increase or rise, owing to the solution not being able to escape from the vessel past the blocked carbon bag and with solution still being fed into vessel 1).

Claim 7) An oil/water separating device using a floating oleophilic bag as claimed previously can use the indicating rod 9 or similar indicator to stabilise the oleophilic bag in the vessel by passing the indicating rod or similar indicator 9 through the oleophilic bag and connecting it to the top end or the bottom end or both ends of the oleophilic bag.

Claim 8) An oil/water separating device using a floating oleophilic bag as claimed in claim 1), in claim 2), in claim 3), in claim 4), in claim 5), in claim 6) and in claim 7) will be more efficient if the dead-weight of the oleophilic bag is supported so that initially little or no part of the oleophilic bag is beneath the surface of the solution so that water cannot be prematurely adsorbed by the oleophilic bag to prevent its proper and efficient use.

Claim 9) An oil/water separating device using a floating oleophilic bag as claimed previously will be more efficient as any blockage of the carbon bag will cause the solution level in the primary vessel to increase, causing the fluid pressure at the bottom of the secondary vessel to increase and hence to apply more pressure to overcome the blockage.

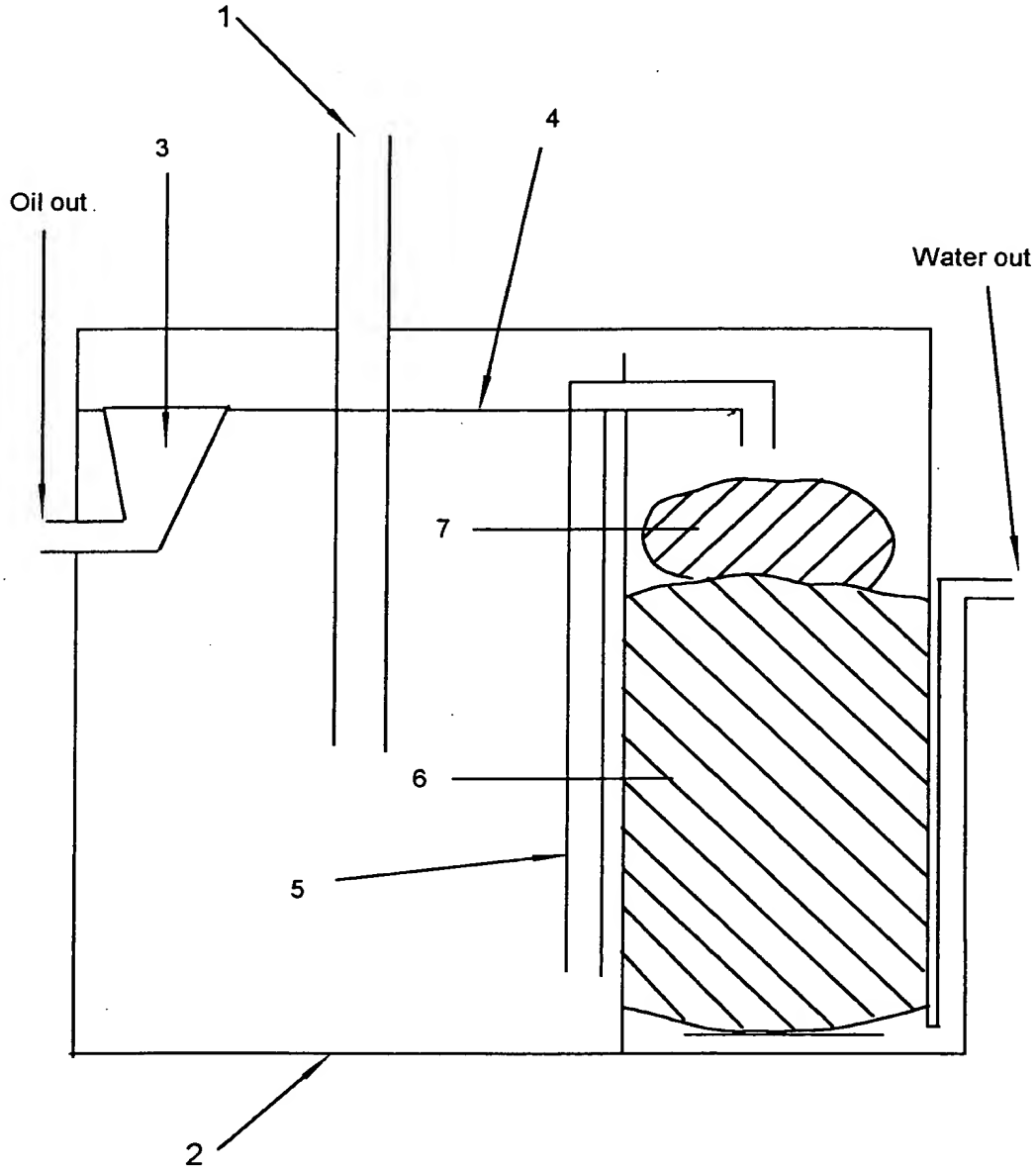
Claim 10) An oil/water separating device as claimed previously but with one vessel instead of two or more vessels and so arranged that the solution introduced into the first vessel passes through or over the oleophilic bag and then over or through a carbon bag or carbon bags contained in the same vessel.

Claim 11 An improved oil/water separating device substantially as described herein with reference to Drawing B.

ABSTRACT

Title: AN IMPROVED OIL/WATER SEPARATING DEVICE
An improved oil/water separating device using an oleophilic and hydrophobic or similar substance or material or similar floating on and in the solution to be treated so that any oil contained in or by any solution passing into the device will probably make contact with and be adsorbed by the oleophilic and hydrophobic substance and any oil not removed by the initial contact with the oleophilic and hydrophobic or similar substance will tend to concentrate at or towards the top or surface of the solution in which the oleophilic and hydrophobic or similar oil attracting substance or material or similar is floating and hence has further opportunity to be adsorbed by and into the oleophilic and hydrophobic material or similar oil attracting substance. The oleophilic and hydrophobic material or similar oil attracting substance will especially remove un-emulsified oil from solutions more efficiently than existing methods, will adsorb more oil and will indicate, by its position in relation to the surface of the solution compared with its initial position when new and unused, the amount of oil contained by it and hence when its replacement becomes necessary.

DRAWING A



DRAWING B